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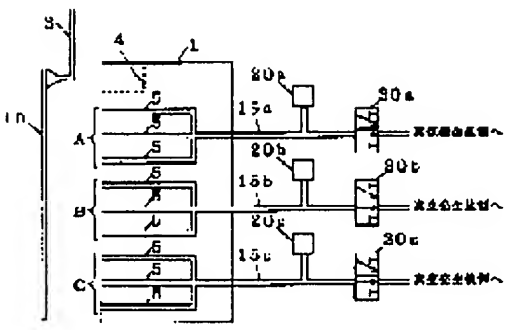
(54) SUBSTRATE ADSORPTION DEVICE AND METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To suck a substrate in such a way as the substrate is free from pattern damage or substrate breakage.

SOLUTION: The adsorption surface of a suction plate 1 is divided into a plurality of blocks A, B and C. The adsorption ports 5 of the respective blocks A, B and C are connected with exhaust pipes 15a, 15b and 15c corresponding to the respective blocks. Furthermore, each block is provided with vacuum sensors 20a, 20b and 20c and valves 30a, 30b and 30c. All vacuum sensors 20a, 20b and 20c and valves 30a, 30b and 30c are connected with a CPU so that the operation control for adsorption and release of adsorption is performed. And, it is possible to perform independent adsorption and release of adsorption for the respective blocks A, B and C and to set the timing of adsorption or release of adsorption for the respective blocks A, B and C. And, since adsorption of a substrate 10 is successively performed for the respective blocks A, B and C, the substrate 10 is free from the occurrence of damage of the pattern or breakage of the substrate 10.



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[Claim(s)]

[Claim 1]When processing to a substrate, while it is a substrate adsorber which carries out adsorption maintenance of said substrate and segmentation of said adsorption face is carried out to two or more blocks by adsorption face in which two or more adsorption mouths were formed, A substrate adsorber providing at least one adsorption mouth in each block, and being able to change supply timings of negative pressure to each adsorption mouth for every block.

[Claim 2]A substrate adsorber, wherein a vacuum sensor which recognizes the state where said substrate was adsorbed by detecting a pressure condition of a negative pressure course which passes to said adsorption mouth for said every block in the substrate adsorber according to claim 1 is formed further.

[Claim 3]When the supply start of the negative pressure is carried out to said negative pressure course and adsorption of said substrate about a block corresponding to specified time elapse of after is not recognized by said vacuum sensor in the substrate adsorber according to claim 2, A substrate adsorber, wherein an unusual warning means which generates an alarm is established further.

[Claim 4]A substrate adsorber, wherein said adsorption face is perpendicular or is made into an inclining state in the substrate adsorber according to any one of claims 1

to 3.

[Claim 5]When processing to a substrate, while being the method of carrying out adsorption maintenance of said substrate and carrying out segmentation of the adsorption face in which two or more adsorption mouths were formed to two or more blocks, Provide at least one adsorption mouth in each block, and adsorption of said substrate is started by supplying negative pressure to said adsorption mouth about a prescribed block first, A substrate adsorption method performing adsorption of other blocks in order which adjoins from said prescribed block one by one along with block arrangement.

[Claim 6]A substrate adsorption method starting adsorption of the following block after checking that a pre- block is adsorbing a substrate normally in an adsorption order of a block sequential substrate in the substrate adsorption method according to claim 5.

[Claim 7]A substrate adsorption method characterized by canceling of a block of the outermost part of an adsorption face one by one along with block arrangement when canceling adsorption of said substrate of a state where adsorption of said substrate is performed in all the blocks, in the substrate adsorption method according to claim 5 or 6.

[Claim 8]A substrate adsorption method carrying out adsorption support of said substrate in the state where a state which stood said substrate perpendicularly, or said substrate was made to incline in the substrate adsorption method according to any one of claims 5 to 7.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]When this invention processes LCD (Liquid Crystal Display), the glass substrate (the following, "substrate") for PDP (Plasma Display Panel), etc., it relates to the substrate adsorber and substrate adsorption method for holding a substrate.

[0002]

[Description of the Prior Art]Where the substrate which is a processing object is held,

it is necessary to perform heat treatment etc., and in the process of processing the glass substrate for LCD, etc., many vacuum absorption is used for maintenance of such a substrate.

[0003]Drawing 15 is a side sectional view of the conventional substrate adsorber used for such a use, and drawing 16 is a perspective view showing the carrying state of the substrate to this device. After the lift pin 102 inserted in the breakthrough 104 in drawing 15 (a) has gone up, the transportation arm 105 of drawing 16 lays the substrate 10 in the lift pin 102. And it descends, while the lift pin 102 had supported the substrate 10 horizontally, and the substrate 10 is laid in the upper surface of the adsorption plate 101 (drawing 15 (b)). Two or more adsorption mouths 103 are formed in the adsorption face (upper surface) of the adsorption plate 101.

This adsorption mouth 103 is connected to vacuum generators, such as a vacuum pump which is not illustrated.

And adsorption maintenance of the substrate 10 is carried out by carrying out negative pressure suction from the adsorption mouth 103 at the upper surface of the adsorption plate 101.

[0004]

[Problem(s) to be Solved by the Invention]By the way, the glass substrate for LCD has what has the still thinner thickness from an around 1-mm thing, for example, In the process of being easy to produce bending etc. with prudence etc. also in a natural state, and manufacturing LCD, since processing of various thin film forming, heat treatment, etc. is performed, in many cases, bending arises according to the kind of thin film currently formed, the given kind of heat treatment, etc. at a substrate. And if it is going to adsorb the substrate which bending produced in this way with the conventional substrate adsorber, it is stabilized and an entire substrate cannot be adsorbed uniformly -- a part will be in the state which is distant from an adsorption face, without [the] bending and being able to adsorb a portion. In such a case, the unevenness of heat distribution arises in a thermal treatment equipment, or. For example, various inconvenience -- a substrate and a nozzle contact, they are damaged, and in being severe in the device which makes the substrate and nozzle like a statement approach JP,8-173875,A very much, and applies liquids and solutions to a substrate, a substrate

breaks in the suction force committed to a substrate -- occurs.

[0005]In recent years, the board size which should be processed compared with the former is enlarged, and conveyance in the state where the substrate was horizontally supported like before is difficult. This is because bending and curvature will arise in a substrate with prudence, and conveyance of a substrate will become difficult or a crack of a substrate will occur, if the transportation arm conveyed where the circumference of a substrate as shown in drawing 16 is supported is used.

[0006]In light of the above-mentioned problems, this invention is ****. The purpose is to provide the substrate adsorber and substrate adsorption method which are stabilized, can adsorb certainly and do not generate various inconvenience by poor adsorption, such as a crack of a substrate.

[0007]An object of this invention is to provide the substrate adsorber and substrate adsorption method which are stabilized, and can adsorb a large-sized substrate certainly, and do not generate the inconvenience by poor adsorption.

[0008]

[Means for Solving the Problem]When processing to a substrate, while it is a substrate adsorber which carries out adsorption maintenance of the substrate and segmentation of the adsorption face is carried out to two or more blocks by adsorption face in which two or more adsorption mouths were formed, the invention according to claim 1, At least one adsorption mouth is provided in each block, and supply timings of negative pressure to each adsorption mouth can be changed for every block.

[0009]When the invention according to claim 2 detects a pressure condition of a negative pressure course which passes to an adsorption mouth for every block in the substrate adsorber according to claim 1, a vacuum sensor which recognizes the state where a substrate was adsorbed is formed further.

[0010]When the invention according to claim 3 carries out the supply start of the negative pressure to a negative pressure course in the substrate adsorber according to claim 2 and adsorption of a substrate about a block corresponding to specified time elapse of after is not recognized by a vacuum sensor, an unusual warning means which generates an alarm is established further.

[0011]In the substrate adsorber according to any one of claims 1 to 3, the invention according to claim 4 has a perpendicular adsorption face, or is made into an inclining state.

[0012]When the invention according to claim 5 processes to a substrate, while it is the method of carrying out adsorption maintenance of the substrate and carries out segmentation of the adsorption face in which two or more adsorption mouths were formed to two or more blocks, At least one adsorption mouth is provided in each block, by supplying negative pressure to an adsorption mouth about a prescribed block first, adsorption of a substrate is started and adsorption of other blocks is performed in order which adjoins from a prescribed block one by one along with block arrangement.

[0013]In the substrate adsorption method according to claim 5, in an adsorption order of a block sequential substrate, the invention according to claim 6 starts adsorption of the following block, after checking that a pre- block is adsorbing a substrate normally.

[0014]In the substrate adsorption method according to claim 5 or 6, when the invention according to claim 7 cancels adsorption of a substrate of a state where adsorption of a substrate is performed in all the blocks, it is canceled of a block of the outermost part of an adsorption face one by one along with block arrangement.

[0015]The invention according to claim 8 carries out adsorption support of the substrate in the state where a state or a substrate which stood a substrate perpendicularly was made to incline, in the substrate adsorption method according to any one of claims 5 to 7.

[0016]

[A method used as the background of an invention] Before describing this embodiment of the invention, "vertical processing of a substrate" as a technical method used as that background and a problem produced in there are examined.

[0017]To convey with enlargement of the latest board size like point **, standing a substrate perpendicularly is tried. And with shift to a perpendicular support gestalt of a conveyance gestalt of a substrate from a level support gestalt, also when performing various processings to a substrate, slanting processing which performs substrate treatment in vertical processing or the state where it was made slanting which performs substrate treatment where a substrate is stood perpendicularly can be

considered. Here, it is called vertical processing including both. And when carrying out adsorption support of the substrate in such vertical processing and processing heating etc., using an adsorption face of a substrate adsorber of a level support gestalt in a Prior art of point **, standing it in the perpendicular direction is also considered.

[0018]Such composition is shown in drawing 1. Drawing 1 is a perspective view showing a substrate adsorber which carries out adsorption support where a substrate is stood to a perpendicular Z direction. As shown in drawing 1, two or more adsorption mouths 5 are formed in the adsorption plate 1, and the crevice 4 for storing the conveyer style 3 for conveying the substrate 10 is further formed in an upper bed portion of the adsorption plate 1. And this substrate adsorber conveys the substrate 10 in the direction of X, after the conveyer style 3 has maintained a field of the substrate 10 at a Y-Z flat surface and parallel, and if it is arranged to such an extent that the substrate 10 touches an adsorption face in which the adsorption mouth 5 of the adsorption plate 1 was formed, adsorption of the substrate 10 will be started. Here, although a gestalt in which the conveyer style 3 supports a substrate is an adsorption support gestalt, it is not limited to this. An arrangement configuration of an adsorption mechanism for adsorbing a substrate in such a device is shown in drawing 2. As shown in drawing 2, two or more adsorption mouths 5 formed in an adsorption face of the adsorption plate 1 are altogether connected to the one exhaust pipe 15, and the vacuum sensor 20 is further attached to the exhaust pipe 15. And the exhaust pipe 15 is connected to vacuum generators, such as a vacuum pump, via the valve 30. That is, by opening and closing the valve 30, the substrate 10 can be adsorbed or an adsorbed state can be canceled. And the vacuum sensor 20 is a sensor for the substrate 10 to judge whether it adsorbs normally.

[0019]However, such a substrate adsorber cannot adsorb a substrate normally, when a large-sized substrate has curvature. This example is explained.

[0020]Drawing 3 is a figure showing the case where the substrate which has curvature in the lower part in the device of drawing 2 is adsorbed. First, it is in the position of the substrate ten P1, and is conveyed to the position of the conveyer style three P2. Although the upper part of the substrate 10 touches the adsorption face of the adsorption plate 1 in this position P2, since there is curvature in the lower part of the

substrate 10, a crevice arises between the lower part of the substrate 10, and the adsorption face of the adsorption plate 1. Even if it is going to attract the whole surface of the substrate 10 simultaneously in such the state, since the substrate 10 is distant from the adsorption face depending on the grade of the curvature of the substrate 10, the pressure in the single exhaust pipe 15 connected with all the adsorption mouths does not fall, and the substrate 10 cannot be adsorbed after all in an adsorption face. And in such a case, various inconvenience occurs like the above-mentioned. This is also the same as when the center section of the substrate has curvature. Drawing 4 is a figure showing the case where the substrate which has curvature in a center section in the device of drawing 2 is adsorbed. Even if the substrate 10 is conveyed by the position of P2 by the conveyer style 3 from the position of P1, only the both ends of the substrate 10 adsorb previously and the center section is in the state where it floated from the adsorption face of the adsorption plate 1. And when it continues attracting an entire substrate simultaneously further in such the state, a portion with curvature may be finally damaged with the suction force.

[0021]Therefore, this invention takes an embodiment which is described below.

[0022]

[Embodiment of the Invention]Drawing 5 is a key map of the substrate adsorber in which an example of this embodiment of the invention is shown. The substrate adsorber of this invention carries out segmentation of the adsorption face for carrying out vacuum absorption (generally "negative pressure adsorption") of the substrate to two or more blocks, and has an adsorption mechanism for every block. In the example of drawing 5, the three adsorption mouths 5 are constituted as one block, it goes caudad and segmentation of each block is carried out to A blocks, B blocks, C blocks, and three blocks from the top at order. The three adsorption mouths 5 in A blocks are connected to the one exhaust pipe 15a, and the vacuum sensor 20a is further attached to the exhaust pipe 15a. And the exhaust pipe 15a is connected to vacuum generators, such as a vacuum pump, via the valve 30a. That is, by opening and closing the valve 30a, the portion corresponding to A blocks of the substrate 10 can be adsorbed, or an adsorbed state can be canceled. If a valve is opened in this embodiment, adsorption of a substrate will be performed, and adsorption will be canceled if a valve is closed.

Furthermore, the vacuum sensor 20a is a sensor for the portion corresponding to A blocks of the substrate 10 to judge whether it adsorbs normally. And it has the vacuum sensors 20b and 20c and the valves 30b and 30c for every block also about B blocks and C blocks, and is the same composition as A blocks. And it is possible to perform operation of adsorption and adsorption release according each block to supply and a stop of negative pressure independently.

[0023]Below, the composition which performs control of adsorption or adsorption release about each block is explained. Drawing 6 is a control block diagram in the substrate adsorber of this invention. As shown in drawing 6, the vacuum sensors 20a, 20b, and 20c and the valves 30a, 30b, and 30c of each block of A, B, and C are altogether connected to CPU40, and the memory 50 and the alarm generator 60 are further connected to CPU40. In such composition, the data of an adsorption order required for the memory 50 when adsorbing or adsorption canceling a substrate, an adsorption release order, etc. is memorized. And CPU40 reads data from the memory 50 and controls each valve according to the data. In adsorbing a substrate in order (A blocks, B blocks, and C blocks) here, it opens in order of the valve 30a, the valve 30b, and the valve 30c, and adsorbs the substrate one by one for every block. Since the vacuum sensors 20a, 20b, and 20c are formed in each block, after checking whether CPU40 is normally adsorbed in the substrate for every block, the valve of the following block can be opened. In order to have the alarm generator 60, it is possible to emit an alarm, when poor adsorption of a substrate occurs.

[0024]The procedure of actually adsorbing a substrate is explained in the substrate adsorber of such composition. Drawing 7 thru/or drawing 9 are the figures showing the procedure of adsorbing a substrate in the substrate adsorber of this invention. Each figure shows the adsorption procedure of the substrate in case there is curvature to the substrate.

[0025]First, the case where the lower part of the substrate 10 has curvature as shown in drawing 7 is explained. The substrate 10 which first has curvature in the lower part as shown in drawing 7 (a) is conveyed by the conveyer style 3. And if the substrate 10 reaches an adsorption face, it will stop in the position. Since the crevice 4 is established in the adsorption plate 1 at this time, the substrate support portion of the

conveyer style 3 of a substrate is accommodated in the crevice 4, and the adsorption plate 1 does not become an obstacle of the conveyer style 3. And if the substrate 10 reaches an adsorption face, the upper part of the substrate 10 will be in the state of touching the adsorption plate 1, like drawing 7 (a). Adsorption of the substrate 10 is started in this state. Negative pressure is supplied to A blocks at first, and the adsorption start of the substrate 10 is carried out from these A blocks. That is, CPU40 checks that open the valve 30a and the output from the vacuum sensor 20a shows a vacuum (pressure below a specifically predetermined minute value) after progress of predetermined time by instructions of CPU40 shown in drawing 6. It is equivalent to a substrate showing that it adsorbed normally that a vacuum sensor shows a vacuum. Since it is in the state (adsorption is poor) where the substrate is not adsorbed normally when a vacuum sensor does not show a vacuum here, when CPU40 orders to the alarm generator 60 (refer to drawing 6), the alarm generator 60 emits an alarm. It is because inconvenience, such as a crack, may arise in a substrate when processing to a substrate is performed in the state where adsorption is poor.

[0026]And if adsorption of the substrate 10 is normally performed about A blocks, it will shift to B-block adsorption next. CPU40 opens the B-block valve 30b, and it sticks to it by supplying negative pressure to the portion corresponding to B blocks of the substrate 10. Since the substrate adsorbs normally at A blocks in the state which shows in drawing 7 (a) at this time, even if the substrate 10 has curvature in the B-block portion which adjoins A blocks, the interval of the substrate 10 and an adsorption face will be narrow. Therefore, the pressure in the exhaust pipe 15b connected only to the B-block adsorption mouth 5 declines comparatively easily, and with sufficient suction force, the B-block portion of the substrate 10 is attracted and it adsorbs it (drawing 7 (b)). And CPU40 recognizes having adsorbed the substrate 10 with the output of the vacuum sensor 20b. Since adsorption is poor when adsorption is not normally performed like A blocks, CPU40 sends a signal to the alarm generator 60, and the alarm generator 60 emits an alarm.

[0027]And if adsorption of the substrate 10 is normally performed about B blocks, C-block adsorption will be performed next. CPU40 opens the C-block valve 30c, and it sticks to it by supplying negative pressure to the portion corresponding to C blocks

of the substrate 10. Since the substrate adsorbs normally at B blocks in the state which shows in drawing 7 (b) at this time, even if the substrate 10 has curvature in the C-block portion which adjoins B blocks, the interval of the substrate 10 and an adsorption face will be narrow. Therefore, the pressure in the exhaust pipe 15c connected only to the C-block adsorption mouth 5 declines comparatively easily, and with sufficient suction force, the C-block portion of the substrate 10 is attracted and it adsorbs it (drawing 7 (c)). When poor adsorption occurs, the alarm generator 60 emits an alarm like other blocks.

[0028]Operation of recognizing the adsorbed state of the substrate 10 with the vacuum sensors 20a, 20b, and 20c may recognize an adsorbed state collectively, after opening the valves 30a, 30b, and 30c of all the blocks one by one. That is, after opening a valve in order (A blocks, B blocks, and C blocks), it can be recognized whether its adsorption is poor before checking the output of the vacuum sensor of each block also carries out processing to a substrate. However, even if the block which has generated poor adsorption exists in this case, adsorption of the following block will be started. Therefore, it is preferred that the block recognizes whether it adsorbed normally after the adsorbing operation of one block.

[0029]In such an adsorption procedure, the processing sequence of CPU40 is shown in drawing 8. First, CPU40 opens the valve 30a and supplies negative pressure to A blocks (Step S11). And CPU40 reads the pressure value which the vacuum sensor 20a shows (Step S12). And CPU40 judges how [to which A-block adsorption was normally performed based on the pressure value acquired at Step S12] it is (Step S13). If A-block adsorption is performed normally here, CPU40 will open the valve 30b next and will supply negative pressure to B blocks (Step S21). And CPU40 reads the pressure value which the vacuum sensor 20b shows (Step S22). And CPU40 judges how [to which B-block adsorption was normally performed based on the pressure value acquired at Step S22] it is (Step S23). And if B-block adsorption is performed normally, next, CPU40 will open the valve 30c and will supply negative pressure to C blocks (Step S31). And CPU40 reads the pressure value which the vacuum sensor 20c shows (Step S32). And CPU40 judges how [to which C-block adsorption was normally performed based on the pressure value acquired at Step S32] it is (Step S33).

Processing will be ended if C-block adsorption is also performed normally here. On the other hand, in Step S13, S23, and S33, when adsorption of each block has abnormalities (i.e., when the value beyond a minute value predetermined in the value which each vacuum sensor shows is shown), CPU40 issues instructions to the alarm generator 60, and the alarm generator 60 emits an alarm (Step S40). Although it becomes the above processing sequences, In drawing 8, processing of Steps S11-S13 is made into A block adsorption treatment (Step S10), make processing of Steps S21-S23 into B block adsorption treatment (Step S20), and let processing of Steps S31-S33 be C block adsorption treatment (Step S30).

[0030]By taking such an adsorption procedure, it can stick to the adsorption plate 1 one by one, without producing inconvenience, like a substrate can be broken also by a substrate with curvature as shown in drawing 7 (a).

[0031]The case where the center section of the substrate 10 next has step shape curvature as shown in drawing 9 is explained. The substrate 10 which first has curvature in a center section as shown in drawing 9 (a) is conveyed by the conveyer style 3. And if the substrate 10 reaches an adsorption face, it will stop in the position. Since it has a crevice between the upper part of the substrate 10, and the adsorption face of the adsorption plate 1 at this time, full storage of the conveyer style 3 is not carried out into the crevice 4. And since the lower part of the substrate 10 is in contact with the adsorption face of the adsorption plate 1, negative pressure is supplied to C blocks and adsorption of a substrate is started sequentially from these C blocks. And recognition of that the adsorption plate 1 was normally adsorbed in the portion corresponding to C blocks of the substrate 10 in CPU40 with the pressure value acquired from the vacuum sensor 20c after progress of predetermined time will start B-block adsorption next. Since the substrate adsorbs normally at C blocks in the state which shows in drawing 9 (a) at this time, even if the substrate 10 has curvature in the B-block portion which adjoins C blocks, the interval of the substrate 10 and an adsorption face will be narrow. Therefore, the pressure in the exhaust pipe 15b connected only to the B-block adsorption mouth 5 declines comparatively easily, and with sufficient suction force, the B-block portion of the substrate 10 is attracted and it adsorbs it (drawing 9 (b)). And if B-block adsorption is performed normally, A-block

adsorption will be started next. Since the substrate adsorbs normally at B blocks in the state which shows in drawing 9 (b) at this time, even if the substrate 10 has curvature in the A-block portion which adjoins B blocks, the interval of the substrate 10 and an adsorption face will be narrow. Therefore, the pressure in the exhaust pipe 15a connected only to the A-block adsorption mouth 5 declines comparatively easily, and with sufficient suction force, the A-block portion of the substrate 10 is attracted and it adsorbs it (drawing 9 (c)). And it means that the substrate was normally adsorbed in all the blocks. During advance of the processing shown in drawing 9, when it drives gradually so that the crevice between the upper part of the substrate 10 and the adsorption plate 1 may be abolished, and A-block adsorption is performed, the whole surface of a substrate comes to stick the conveyer style 3 to an adsorption plate.

[0032]In such an adsorption procedure, the processing sequence of CPU40 is shown in drawing 10. First, C block adsorption treatment (Step S30) is performed, and B block adsorption treatment (Step S20) is performed to the next. And it becomes an order of finally performing A block adsorption treatment (Step S10). The details of the adsorption treatment (Step S30, S20, S10) of each block here are the same as that of the processing shown in drawing 8. And in the adsorption treatment of each block, if an adsorbed state is judged not to be normal, the alarm generator 60 will be ordered CPU40 and it will emit an alarm (Step S40). Thus, the processing in this case is completed.

[0033]It is possible to adsorb a substrate normally, without producing inconvenience, like a substrate can be broken also about the substrate 10 as shown in drawing 9 (a) by taking such an adsorption procedure.

[0034]The case where the center section of the substrate 10 next has convex curvature as shown in drawing 11 is explained. The substrate 10 which first has curvature in a center section as shown in drawing 11 (a) is conveyed by the conveyer style 3. And if the substrate 10 reaches an adsorption face, it will stop in the position. And in such a case, adsorption is first started from the center section (B blocks) of the substrate 10. In this case, since the adsorption face of the B-block circumference is in contact with the substrate 10, Even if separated from some in a B-block portion of the adsorption face and the substrate 10, by B-block suction, a pressure in the meantime declines

comparatively easily by suction from the exhaust pipe 15b, and with sufficient suction force, the B-block portion of the substrate 10 is attracted and it adsorbs it. By adsorbing and lengthening the portion by which the substrate 10 was bent at B blocks, at this time, Even if a position shift arises somewhat in the substrate 10 in the portion equivalent to A blocks and C blocks, since the substrate 10 is not adsorbed, at A blocks and C blocks, breakage of the substrate 10, etc. do not produce it (drawing 11 (a)). CPU40 -- and if adsorption which is B blocks is performed normally, adsorption (A blocks and C blocks) will be performed next. It may carry out to timing which may perform adsorption (A blocks and C blocks) simultaneously, and is different. And when adsorption is normally performed also about A blocks and C blocks, it means that adsorption was performed about the whole surface of the substrate 10 (drawing 11 (b)).

[0035]When the substrate 10 can be adsorbed in order (order (A blocks, B blocks, and C blocks) or C blocks, B blocks, and A blocks) and an entire substrate can be normally adsorbed about the case where the center section of such a substrate 10 has convex curvature, it may adsorb in such an order.

[0036]In an adsorption procedure as shown in drawing 11, the processing sequence of CPU40 is shown in drawing 12. First, B block adsorption treatment (Step S20) is performed, and processing of A blocks and C-block adsorption is performed to the next. That is, negative pressure is supplied to A blocks and C blocks (Step S51), and CPU40 reads the pressure value which the vacuum sensors 20a and 20c show to the next (Step S52). And it judges whether adsorption (A blocks and C blocks) is normal (Step S53), and processing will be ended if normal. moreover -- ordering the alarm generator 60 CPU40, when adsorption of a substrate is not normal in Step S20 and Step S53 -- an alarm -- emitting (Step S40) -- it is carried out.

[0037]The gestalt of selection of by which procedure to adsorb a substrate among the adsorption procedures of the substrate explained so far is explained. The gestalt of the 1st selection measures beforehand what kind of curvature arises in a substrate in the process in front of the substrate processing device with which the substrate adsorber of this invention was applied, and is a gestalt which chooses one adsorption procedure based on that measured data. This is a gestalt which considers two or more substrates

as one settlement, and chooses an adsorption procedure for the settlement of every like every lot. The gestalt of the 2nd selection is a gestalt which measures the curvature state of a substrate and makes auto select of every one adsorption procedure based on the measured data by a sensor etc., when a conveyer style conveys a substrate to the substrate adsorber of this invention. The gestalt of the 3rd selection is a gestalt which an operator etc. observe the substrate which a conveyer style conveys, chooses one adsorption procedure at a time, and is set up. These three gestalten are applied to the substrate adsorber of this invention.

[0038]Below, the procedure of canceling an adsorbed state is explained from the state where the adsorption plate is adsorbed in the substrate. When CPU40 shown in drawing 6 closes the valve corresponding to each block, respectively, ordinary pressure opening of the exhaust pipe of each block is carried out, and the adsorbed state of a substrate is canceled. And when canceling the adsorbed state of a substrate, to cancel of the periphery of a substrate in principle is required. That is, by canceling of the periphery of the substrate, air can be made to intervene gradually between a substrate and the adsorption face of an adsorption plate, and it becomes possible to cancel the adsorbed state of a substrate easily. For example, in the case of the block configuration which carried out segmentation to three blocks, A, B, and C, which were mentioned above, After canceling order (order (A blocks, B blocks, and C blocks), C blocks, B blocks, and A blocks) or A blocks, and C blocks, the order of canceling B blocks can cancel adsorption of an entire substrate easily.

[0039]Although reference was made about the case where a substrate has curvature, in old explanation, If segmentation of the adsorption face of the adsorption plate 1 is carried out to two or more blocks like this embodiment and the timing of adsorption and adsorption release is changed for every block even when there is no curvature in a substrate, it is possible to reduce the possibility of brittle breakage of a substrate. And from A blocks nearest to a conveyer style, the procedure of desirable adsorption in case there is no curvature in a substrate starts adsorption, continues, and is order (B blocks and C blocks). From A blocks nearest to a conveyer style, the desirable procedure of canceling an adsorbed state performs release, continues, and is order (B blocks and C blocks).

[0040]In this embodiment, if each block configuration of the adsorption plate 1 is seen from the adsorption face of a substrate, it has composition shown in drawing 13. In this figure, the number of adsorption mouths is arbitrary. The procedure of adsorption of the substrate explained until now uses the gestalt to which segmentation of the lengthwise direction of an adsorption plate as shown in drawing 13 was carried out. However, the gestalt of the segmentation of the adsorption face of the adsorption plate in this invention is not limited to drawing 13. Other examples are shown in drawing 14.

[0041]Drawing 14 is a figure showing other examples of each block configuration which performs substrate adsorption of this invention. As shown in drawing 14, the segmentation of a block of the adsorption face of this adsorption plate is the matrix form segmentation of the lengthwise direction of an adsorption plate, and a transverse direction. And although not illustrated, the vacuum sensor and the valve are provided for every block, and CPU can carry out control of adsorption and adsorption release for each block independently. Thus, when two or more blocks serve as two-dimensional arrangement, it can respond also to the curvature of a complicated substrate.

[0042]In the substrate adsorber of this invention explained until now, when canceling adsorption of a substrate, it is still more possible by spraying air on the substrates face by the side of an adsorption plate to also make an air layer form between a substrate and an adsorption plate. Although it is realizable with the adsorption mouth currently formed in the adsorption plate, the composition of forming a diffuser independently may be sufficient as the diffuser for spraying the air in this case. What is necessary is just to be able to switch three states of a vacuum generator, ordinary pressure opening, and an air supply machine for the connected state of an exhaust pipe by a valve, in order for an adsorption mouth to serve as a diffuser.

[0043]Process treatment, such as processing in which the substrate adsorber explained by this embodiment heats a substrate, processing which cools a substrate, processing which applies coating liquid to a substrate, processing which develops a substrate, and processing which washes a substrate, etc. It is possible to apply as a mechanism which supports the substrate of all the substrate processing devices including what etc.

adsorbs a substrate for processings, such as position converting of a substrate and movement. Processing of those substrate processing devices does not ask processing in the state where the substrate was stood, processing in the state where the substrate was made to incline, and processing in the state where the substrate was leveled further. That is, in all the states in the state which stood the substrate perpendicularly, the state where the substrate was made to incline, and the state where the substrate was leveled further, it is usable in this substrate adsorber.

[0044]

[Effect of the Invention]As explained above, while segmentation of the adsorption face is carried out to two or more blocks according to the invention according to claim 1, At least one adsorption mouth is provided in each block, and since it can change for every block, the supply timings of the negative pressure to each adsorption mouth can be adsorbed one by one at an adsorption plate, without breaking a substrate.

[0045]According to the invention according to claim 2, since the vacuum sensor which recognizes the state where the substrate was adsorbed by detecting the pressure condition of the negative pressure course which passes to an adsorption mouth for every block is formed further, the portion corresponding to each block of a substrate can recognize whether it adsorbs normally.

[0046]When according to the invention according to claim 3 the supply start of the negative pressure is carried out to a negative pressure course and adsorption of the substrate about the block corresponding to specified time elapse of after is not recognized by a vacuum sensor, Since the unusual warning means which generates an alarm is established further, it is possible to emit an alarm, when poor adsorption of a substrate occurs.

[0047]According to the invention according to claim 4, the adsorption face is perpendicular or the thing which was suitable for large-sized substrate treatment since it was considered as the inclining state.

[0048]While carrying out segmentation of the adsorption face in which two or more adsorption mouths were formed to two or more blocks according to the invention according to claim 5, Provide at least one adsorption mouth in each block, and adsorption of a substrate is started by supplying negative pressure to an adsorption

mouth about a prescribed block first, Since adsorption of other blocks is performed in the order which adjoins from a prescribed block one by one along with block arrangement, it can adsorb one by one, without breaking a substrate.

[0049]According to the invention according to claim 6, in an adsorption order of a block sequential substrate, in order to start adsorption of the following block after checking that the pre- block is adsorbing the substrate normally, when the block which has generated poor adsorption exists, adsorption of the following block is not performed.

[0050]When canceling adsorption of a substrate of the state where adsorption of a substrate is performed in all the blocks according to the invention according to claim 7, In order to cancel of the block of the outermost part of an adsorption face one by one along with block arrangement, air can be made to intervene gradually between a substrate and the adsorption face of an adsorption plate, and it becomes possible to cancel the adsorbed state of a substrate easily.

[0051]According to the invention according to claim 8, in order to carry out adsorption support of the substrate in the state where the state or substrate which stood the substrate perpendicularly was made to incline, it is a thing suitable for large-sized substrate treatment.

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⑤4発明の名称　近距離用レーダ・センサ

⑳特　願　昭62-245173

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明　細　書

1. 発明の名称

近距離用レーダ・センサ

2. 特許請求の範囲

(1) 周波数が時間に対して線形に変化するFM変調器と、その出力を増幅し空中へ放射する送信アンテナと、ある物体からの反射波を受信する受信アンテナと、送信波および受信波を周波数混合してビート周波数を検出するミキサと、送信波および受信波をそれぞれてい倍したのちミキサに入力する手段とを具備したことを特徴とする近距離用レーダ・センサ。

(2) 送信波および受信波を同一の固定周波数発振器で低い周波数へ変換して、それぞれてい倍することを特徴とする特許請求の範囲第1項記載の近距離用レーダ・センサ。

3. 発明の詳細な説明

産業上の利用分野

本発明はレーダを用い、車両検出器等に利用される近距離用レーダ・センサに関するものである。

従来の技術

近距離の距離センサとしては従来より超音波、光、電磁波等を利用した方式が提案されているが、電磁波を用いる場合は、マイクロ波～ミリ波帯の周波数を用いたパルスあるいはFW-CWレーダが実用化されている。検出距離が1～10m の場合、パルス・レーダでは送信および受信のパルスの時間差が極めて短いため分解能が悪く、FM-CWレーダが好んで用いられる。

まず最初に第3図、第4図を用いてFM-CWレーダの原理について説明する。第4図において、101は三角波発生器でその周期はTo とする。この出力はFM変調器102の変調端子に加えられ、中間周波数 fo 、周波数偏移△Fのマイクロ波～ミリ波帯におけるFM波を発生する。このFM変調器102の出力は電力分配器103を介し、電力が2分配され一つは送信用増巾器104、他の1つは受信ミキサ111の局部電力となる。送信用増巾器104の出力は送信アンテナ106より電波として放射され、目標物107でその電

力波の一部は反射され受信アンテナ108を通り、受信用増巾器110で増巾されミキサ111に加えられる。ミキサ111は、送信波と受信波を混合しそのビート成分 f_b を検出し、端子112に出力する。

いま送受信アンテナ106、108は近接しているとして、アンテナ106、108から目標物107までの距離をLとする。送信波と受信波の周波数の変化の様子を第4図に示す。実線は送信波、破線は受信波の周波数の変化をあらわしている。送信波と受信波に$\triangle T$だけの時間差があり、検出されるビート周波数を f_b とすると、

$$f_b = \triangle F \cdot \triangle T / (To/2)$$

$$= \frac{2\triangle T}{To} \cdot \triangle F \qquad \cdots (1)$$

また$\triangle T$は電波の伝搬速度をCoとして

$$\triangle T = 2L/Co$$

であるから

$$f_b = \frac{4\triangle F}{To \cdot Co} \cdot L$$

また三角波のくりかえし周期を f_p ($=1/To$) とすると、

$$f_b = 4 \cdot \triangle F \cdot f_p \cdot L/Co \qquad \cdots (2)$$

となり、f_b は$\triangle F$、f_p を一定とすると距離Lに比例することがわかる。したがって、ビート周波数 f_b を検出することにより距離Lを容易に求めることが可能となる。

発明が解決しようとする問題点

FM－CWレーダのビート周波数は上記第(2)式の如く与えられるが、実際の測定においては $f_b \gg f_p$、すなわちビート周波数 f_b は三角波のくりかえし周期 f_p より十分大きくなければならない。いま $f_p \simeq \frac{1}{10} f_b$ とし、最小検出距離を L_{min} とすると

$$4\triangle F \cdot \left(\frac{L_{min}}{Co}\right) > 10$$

となる。$L_{min} = 1$ m とすると $C = 3 \times 10^8$ m であるから $\triangle F$ 7 7.5×10^8 (Hz) $= 750$ MHz となり、周波数偏移のきわめて大きなFM変調器が要求され、帯域およびFM線形性の点で装置を実現するうえでも問題となるほか、他の無線装置にも妨害を与える可能性が高いという欠点を有していた。本発明は測定精度向上を目的とする。

問題点を解決するための手段

上記目的を達成するために、本発明は送信波と受信波を直接もしくは一度周波数の低い中間周波数に変換したのち周波数てい倍してミキサに入力するようにしたものである。

作　用

上記構成において、周波数てい倍された送信波と受信波をミキサに入力レビート周波数を検出する。検出されたビート周波数は周波数が高くなって実効的に周波数偏移を大きくすることができ、測定精度の向上を図ることができる。

実施例

第1図に本発明の第1の実施例における近距離用レーダ・センサのブロック結線図である。第3図の従来例と異なる点は、電力分配器103とミキサ112の間、および受信用増巾器110とミキサ112の間にてい倍器113、114を挿入している点である。てい倍次数をNとすると、送信波と受信波の周波数偏移$\triangle F$もN倍となるから$\triangle F$が見かけ上$N \cdot \triangle F$であらわされ、ビート周波数 f_b もN倍となる。したがって実際に空中を伝搬している電波の周波数偏移をそのままにして実効的に測定精度を向上することが可能となる。

実際には、送信、受信の周波数帯でてい倍動作させると、回路がコスト高となり、動作も不安定となるため、第2図に示すような第2の実施例が実用的である。これは送信波、受信波を固定発振器115とミキサ116および117で数10MHzの中間周波数におとし低域フィルタ(LPF)118、119で高域成分を除去したのち、てい倍器120、121でNてい倍したのち、ミキサ122でビート成分を検出する方法である。この場合もビート周波数はN倍になるが、周波数が低いためてい倍器の設計が容易で、低コスト化できるほか、てい倍次数Nを大きくできるため、近距離測定がさらに容易となる。

発明の効果

以上のように本発明は、ＦＭレーダで近距離の測距を行う際、空中に伝搬している電波の周波数偏移は変えず、ビート検出する際の周波数偏移を実効的に大きくすることにより測定精度向上を可能ならしめる手法を提供するものであり、周波数の有効利用、また妨害低減などの特徴をもつものであり、その工業的価値はきわめて大である。

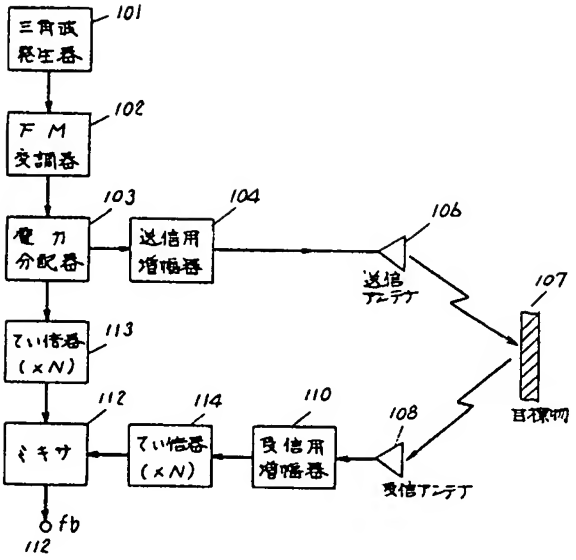
4. 図面の簡単な説明

第１図は、本発明による近距離用レーダ・センサの第１の実施例を示すブロック図、第２図は本発明による近距離用レーダ・センサの他の実施例を示すブロック図、第３図は従来の近距離用レーダ・センサの構成例を示すブロック図、第４図は第３図の構成の周波数変化の説明図である。

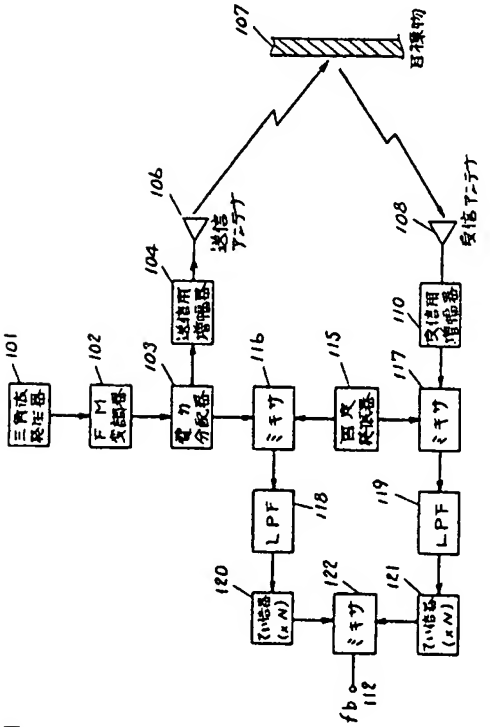
１０１…三角波発生器、１０２…ＦＭ変調器、１０３…電力分配器、１１２、１１６、１１７、１２２…ミキサ、１１３、１２０、１２１…てい倍器、１０６…送信アンテナ、１０８…受信アンテナ。

代理人の氏名　弁理士　中　尾　敏　男　ほか１名

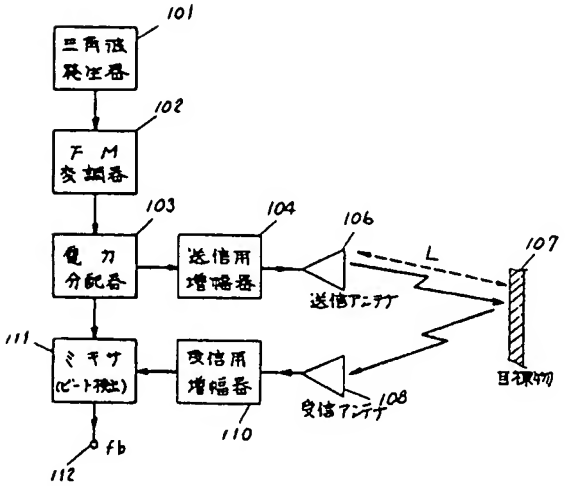
第 1 図



第 2 図



第 3 図



第 4 図